Role of Atmospheric Internal Variability in the Atlantic Meridional Overturning Circulation

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The objectives of this program are 1) to explore the role of atmospheric internal variability (AIV) in both natural variability and forced change of the AMOC and 2) to close the gap in understanding the linkage between the AMOC and the Atlantic Multidecadal Oscillation (AMO) in the context of understanding AMOC's role in the global climate system.

Recent results

Our research over the past year has focused on the relationship between synoptic winter atmospheric variability and modes of climate variability in the North Atlantic, as well as their interactions with ocean circulations in the North Atlantic. Using atmospheric reanalysis datasets, including NCEP-CFSR, NCEP-NCAR, NOAA 20th century reanalysis data, and the observationally derived OAflux dataset, we analyzed boreal winter (November thru March) extreme flux events in the Gulf Stream Region (GSR). These extreme flux events, most of which last less than three days, are characterized by cold air outbreaks with an anomalous northerly wind that brings cold and dry air from the North American continent to the GSR. A close relationship between the extreme flux events over GSR and the East Atlantic Pattern (EAP) is found with more frequent occurrence of the extreme flux events during a positive EAP phase and vice versa. Interestingly, the North Atlantic Oscialtion is closely related to the extreme flux events in the Labrador Sea region. A further lag-composite analysis suggests that the EAP may be explained as a rectified effect of the synoptic winter storms accompanied with the extreme flux events and that the event-day storms tend to have a preferred southeastward propagation path over the North Atlantic, potentially contributing to the southward shift of the storm track over the eastern North Atlantic basin during EAP positive phase. A similar relationship is found between the extreme flux events over the Kuroshio extension region and the Pacific Decadal Oscillation. A paper summarizing these results has been submitted to *Journal of Climate*. Currently, we are investigating how much this synoptic winter atmospheric variability can impact the AMOC.

Bibliography

Ma, X., P. Chang, D. Wu, X. Lin, and R. Saravanan, 2014: Winter extreme flux events in the Kuroshio and Gulf Stream extension regions and relationship with modes of orth Pacific and Atlantic variability. *J. Climate*, in revision.